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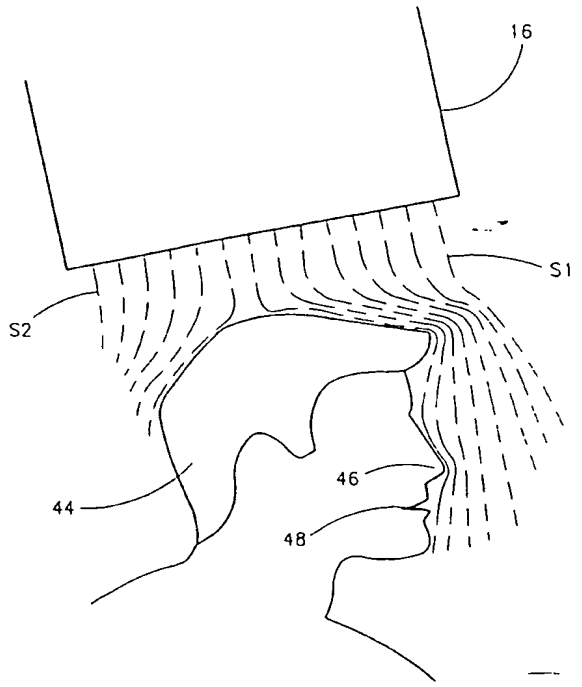
(54) Title: TREATED AIR SUPPLY

(57) Abstract

This invention is a system (10) for treating air which includes an ambient air treatment unit (12) for treating ambient air so as to bring it to a preselected respiratory comfort level, and for providing a treated air outflow; a guide (16) for treated air outflow so as to obtain a selected treated air outflow distribution; and positioning apparatus for selectively positioning the guide relative to the head of a user, thereby to form a treated air envelope (15) surrounding such a user's respiratory openings, and having a preselected respiratory comfort level, thus isolating such a user from ambient conditions.



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TREATED AIR SUPPLY

FIELD OF THE INVENTION

The present invention relates to clean air systems.

BACKGROUND OF THE INVENTION

There are many types of clean air systems in the market, including those which are intended to aid a person suffering from a respiratory condition. Different solutions have been attempted, none of which has yet provided a satisfactory solution.

Asthma is a relatively common, chronic respiratory ailment and, like many non-chronic respiratory ailments, is known to be more of a problem during the night. Nocturnal asthma thus requires a treated air supply that has a lower allergenic content than a similar treated air supply for use during daytime conditions.

The existence of "clean air" or "clean room" conditions is dependent on various factors, all of which contribute to the environment to which the human body is sensitive and to which the human body reacts. The US Federal Standard FS209, for example, defines various criteria by which clean air may be determined, including velocity of airflow, air temperature, relative humidity, rate of temperature change versus time, and a maximum number of particles greater than 0.5 microns per cubic foot.

In order to provide a person in a room with clean air, as described, it has been sought either to provide a 'room' unit, which aims to change and filter the air in the room often enough so as to meet predetermined clean air standards; or to concentrate on a portion of the room, such as the air space associated with a desk or bed. Various other factors also have to be taken into account, however, including the volumetric airflow, the type of flow required in supplying the air the temperature of the clean air and therapeutic effect, the "comfort" effect of these factors on the patient, and the cost, size and weight of the system.

Various commercial systems which aim to provide clean air to a specific portion of the room are known in the art. These include the "Pure Zone System," described in an article entitled "Use of Laminar Control Device as Adjunct to Standard Environmental Control Measures in Symptomatic Asthmatic Children," by R.J. Zwemer and J. Karibo, published in "ANNALS OF ALLERGY," volume 21, June 1973. The described system provides a very high number of air changes per hour, up to as many as approximately 1200. This system supplies clean air to the area of a bed by use of a

very high volumetric flow, of about 700 m^3/H, in a generally horizontal direction. In order to achieve such high performance, however, the system is very large, heavy and expensive, and is thus not necessarily practical for domestic use.

'Area' air cleaners also exist, including the EV-35, manufactured by Honeywell Environmental Air Control Inc., of Houston, Texas 77272-2022, USA and 2800 West Broadway, Minneapolis, MN 55411, USA; the "Multi-5" and "Multi-6," both manufactured by Amcor Ltd., of 98 Yigal Allon Street, Tel Aviv, Israel; "Mountain Breeze"; manufactured by Mountain Breeze Company," of Skelmersdale, WN8 9QB, United Kingdom; the "Kojair 200" and "Kojair 400" systems, both manufactured by Koja Oy, SF-33101, Tampere 10, Finland; and the "ADS SP" unit, manufactured by ADS Laminare, 35-37 Rue Baudin , 93315, Le Prest Gervais Cedex, France. These systems aim either to clean the air in an entire room, such as the EV-35, or to simply change the air over a known area, leaving it to the discretion of a user as to where exactly he wants to position the system. None of these systems has been found to properly change the air, however, so that it is difficult to determine that the air surrounding a user is 'allergen free,' in accordance with recognized standards.

Furthermore, as some of these systems are placed, for example, on the floor, and blow air horizontally, they can actually cause secondary allergen contamination of the air supplied to a user. This is due to the fact that the horizontal airflow may pick up naturally occurring allergens between the system and the user, such as dust that may have collected on the floor or on a desk surface, pollen from flowers, animal matter, and so on.

There also exist various helmet constructions, typically for use by motorcyclists and workers in industrial clear air environments. Some of these are described in US Patents Nos. 4,752,974; 4,901,716; 5,046,492; 5,170,511; 5,245,994 and 5,533,500. These helmets share a common function of air filtration, and provision of substantially contaminant-free air to the wearer. It will of course be appreciated that, while being possibly more efficient than the above 'room' or 'space' clean air systems, these various helmet constructions are intended to be used while performing specific functions, and, if worn for many hours continuously - such as may be required by persons with respiratory conditions, may cause great discomfort. Furthermore, the use of a helmet may severely hamper many normal functions, including eating, conversation, and hearing, such that they do not provide a socially acceptable solution to the provision of clean air.

SUMMARY OF THE INVENTION

It is an aim of the present invention to provide a personal treated air system which, while being highly efficient, provides a localized flow of air to a person, wherein the system is not only highly efficient, but wherein it is operated in accordance with predetermined parameters, varying in a predetermined manner, and which provides optimal comfort to the person.

There is thus provided, in accordance with a preferred embodiment of the invention, a system for treating air which includes an ambient air treatment unit for treating ambient air so as to bring it to a preselected respiratory comfort level and for providing a treated air outflow; a guide for treated air outflow so as to obtain a selected treated air outflow distribution; and positioning apparatus for selectably positioning the guide relative to the head of a user thereby to form a treated air envelope surrounding his respiratory openings, and having the preselected respiratory comfort level, thus isolating the user from ambient comfort conditions.

Additionally in accordance with a preferred embodiment of the invention, the positioning apparatus is operative to enable position the guide apparatus in non-touching association with the head of the user, thereby to direct the treated air past his nasal openings.

Further in accordance with a preferred embodiment of the invention, the air treatment unit includes an insulated housing, defining an ambient air inlet and a treated air outlet; pump apparatus, for pumping ambient air into the housing through the inlet and for pumping treated air out of the housing via the treated air outlet, along a flow path; heater apparatus, located downstream of the inlet, for heating air flowing along the flow path to a preselected temperature; and a filter located upstream of the outlet, for removing contaminants from the air flowing along the flow path.

Additionally in accordance with a preferred embodiment of the invention, the guide is mounted onto the outlet for receiving therefrom the treated air, and defines an outlet having a selectable cross-sectional area.

Further in accordance with a preferred embodiment of the present invention, the guide has a generally elongate, extended shape, which is predetermined so as to generally isolate the respiratory passages of a user from ambient air.

Preferably, the guide is extensible between a relatively retracted position and a relatively extended position, whereat it is operative to generally isolate the respiratory passages of a user from ambient air.

In accordance with a further embodiment of the invention, the air treatment apparatus comprises:

a housing having formed therein ambient air inlet apparatus and treated air outlet apparatus;

an air entry chamber, for receiving ambient air via the air inlet apparatus;

a blower chamber, arranged contiguously with the air entry chamber;

a treated air outlet chamber arranged contiguously with the blower chamber, for providing treated air to the outlet apparatus;

blower apparatus, arranged in the blower chamber, for causing a negative pressure gradient across the blower chamber, thereby causing ambient air to be pumped into the into the air entry chamber through the inlet apparatus and for forcing treated air out of the blower chamber and out of the housing through the air outlet apparatus, via the outlet chamber, along a predetermined flow path; and

filter apparatus, located downstream of the blower apparatus, for removing contaminants from the air flowing along the flow path.

In accordance with an alternative embodiment of the invention, there is provided a method of providing treated air to a person, which includes the steps of treating ambient air so as to bring it to a preselected respiratory comfort level; providing a treated air outflow; and guiding the treated air outflow so as to obtain a flow distribution in close proximity to the head of a user, thereby to form a treated air envelope surrounding his respiratory openings, and having the preselected respiratory comfort level, thus isolating the user from ambient comfort conditions.

Additionally in accordance with the alternative embodiment of the invention, the step of guiding includes guiding the airflow past his nasal openings.

Further in accordance with the alternative embodiment of the invention, the step of guiding the treated airflow includes the sub-step of adjusting the cross-sectional area thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following description, taken in conjunction with the drawings, in which:

Fig. 1 is a generalized diagrammatic representation of a personal system for treating air, constructed and operative in conjunction with a preferred embodiment of the invention;

Fig. 2A is a cross-sectional view of an air treatment unit, seen in Fig. 1;

Fig. 2B is a cross-sectional view of the air treatment unit seen in Figs. 1 and 2A, taken along line B-B in Fig. 2A;

Fig. 3A is a side-sectional view of an adjustable flow guide of the treated air system of Fig. 1, shown in a contracted position;

Fig. 3B is a view similar to that of Fig. 3A, but wherein the guide is seen in an extended position;

Fig. 4 is a diagrammatic side view illustration of stream lines of a treated airflow to which a user is exposed in accordance with the present invention;

Fig. 5 is a pictorial side view of a personal treated air system of the present invention, showing the system in a first operative use;

Fig. 6 is a pictorial side view of a personal treated air system of the present invention, showing the system in a second operative use;

Fig. 7 is a pictorial view of a wall-mounted personal treated air system of the invention;

Figs. 8A and 8B are graphical representations of thermo-stabilized and thermo-regulated regimes by which the system of the invention may be operated;

Fig. 9 is a schematic side-sectional view of an air treatment unit constructed and operative in accordance with an alternative embodiment of the invention.; and

Fig. 10 is a pictorial side view of a system similar to that of Fig. 6, but having an extended flow guide.

DETAILED DESCRIPTION OF THE INVENTION

The present invention seeks to provide an improved, personal system for treating air which, regardless of the environment in which the system is located, and regardless of the position in which a user is situated, provides a treated air envelope surrounding his respiratory passages, so as to effectively isolate him from ambient air conditions, including ambient air comfort conditions. Various parameters of the treated air envelope are adjustable, thereby to provide optimal respiratory comfort conditions for the user. Among adjustable parameters are air temperature, relative humidity, and the effective number of air changes that the user is subjected to (determined by the speed of the airflow). Notwithstanding the fact that the effective rate of air change is relatively high, the present system does not subject the user either to high speed air streams or to unpleasantly high levels of noise.

Referring now briefly to Fig. 1, there is provided, in accordance with a preferred embodiment of the invention, an adjustable, portable, personal system for treating air, referenced generally 10. System 10 includes an air treatment unit 12 into which ambient air is drawn, as indicated by arrows 14. The air is treated, as described below in conjunction with Figs. 2A and 2B, and is then discharged in a controlled outflow, as shown by arrows 15, via an adjustable flow guide 16 attached to the air treatment unit 12.

Unit 12 is supported on an adjustable support which, in the present example, is seen to be a support arm 18 adjustably mounted onto a wheeled support structure, referenced generally 20. It will be appreciated that any suitable type of adjustable support may be employed, including those shown and described below in conjunction with Figs. 5, 6 and 7.

Referring now to Figs. 2A and 2B, it is seen that air treatment unit 12 has an insulated housing 22, in which are formed an untreated air inlet 24 and a treated air outlet 26. The walls of the housing 22 are formed from any suitable sound insulative material, for example, an open- or closed-cell polyethylene foam material such as ILSONIC®, manufactured by Illbruck GmBH, of Leverkusen, Germany. Untreated air entering through inlet 24 is drawn by a fan or blower 30, past a heating unit 28 and a humidifier 65, and past a first partition 29. Heating unit 28 may be, for example, the Zig-Zag™ heating element, as manufactured by Fritz Eichenauer GmBH & Co., D6729, Hazenbul, Industry Strasse 1, Germany. Fan 30 is preferably a centrifugal fan, but any other suitable type of fan or blower may also be used. Humidifier 65 may

include any suitable water receptacle 66, adapted to hold a predetermined volume of water, and having one or more electrical heating elements 67 for causing regulated evaporation of the water.

Air flowing past the heating unit 28 is heated to a temperature determined to be comfortable to the user, both in terms of temperature and humidity, and is blown by the fan, into an inner housing portion, referenced generally 31. A second partition, referenced 32 (Fig. 2A), is located transversely across the flow of heated air, thereby forcing the air to flow around the partition 32, as shown by arrows 34, such that the airflow loses acoustic energy speed; the above-described construction acting as a silencer, thereby to provide a reduced noise air flow to the user.

This airflow is further forced to flow once again inwards, towards an outlet 36, so as to be fed through an air filter 38, of a suitable type, which is located across treated air outlet 26. A preferred type of filter is a "HEPA" filter, as known in the art. The generally outward flow of air is forced through the filter 38, thereby to further lose speed, and emerges from the filter as a gently flowing generally laminar flow, through guide 16.

Referring now to Figs. 3A and 3B, airflow guide 16 may have any suitable adjustable construction, such as a concertina-like construction, as shown and the drawings, or an umbrella-type construction (not shown). The illustrated construction is seen to be formed of a suitable, typically corrugated material, such as a plastic-foil laminate. Inner edges 40 of the guide 16 are attached via suitable hinges 42 to the air treatment unit 12, so as to surround treated air outlet 26. As indicated schematically in Fig. 3A, the area covered by guide 16 in a contracted position, and thus cross-sectional area of the treated airflow is nominally 'A' x 'B.' After extension however, as seen in Fig. 3B, the extended area covered by guide 16, may be increased to 'C' x 'D,' wherein C and D are up to 2-3 times greater than A and B, respectively.

Referring now to Fig. 4, there is seen, in side profile, the head 44 of a person exposed to a treated airflow, in accordance with the present invention. Guide 16 is seen to have been adjusted so as to obtain a desired airflow about the head of the user and, in particular, in contact with the respiratory openings of the user, namely, the nostrils 46 and the mouth 48. It is also of importance that the person's ears (not shown) are exposed to this airflow, as will be understood from the following description.

It will thus be understood that, in contradistinction to prior art systems, in the present invention there is provided a localized treated air envelope - defined by extreme streamlines 'S1' and 'S2'. This provides not only allergen-free air to the respiratory passages of a user, but it also ensures that the environment which surrounds not only the respiratory openings but also the ears and, in fact, the entire head, maintains a preselected respiratory comfort level in the vicinity of the user, thereby to effectively isolate or insulate him from the ambient comfort level. Furthermore, apart from being non-obtrusive, as opposed to the various helmet-based solutions of the prior art, the fact that the treated air flows generally 'downward,' i.e. generally from the crown of the head towards the neck, ensures that no secondary contaminants, such as may be present in the room environment, can be introduced into the air breathed by the user.

It will thus be appreciated that the present invention provides a highly efficient solution for people with chronic conditions, such as asthma and other seasonal conditions for which a controlled breathing environment - both in terms of being contaminant free and also temperature controlled - can be treated by use of the present invention.

While the airflow is illustrated in Fig. 4 as being from above and behind the user's head, it may alternatively be placed above and in front of his head, as long as a desired treated air envelope is provided, as described above.

Referring now to Figs. 5 and 6, in accordance with a further embodiment of the invention, it is seen that the treated air system 10' of the invention may be used by a person both in a sitting position, as seen in Fig. 5, and in a lying down position, as seen in Fig. 6. This is due to the fact that there is provided an articulated support, referenced generally 50, which is constructed so as to be adjustable in at least two dimensions, having arms 52 and 54 which are hinged to each other at a first hinge location 56, and which are further hingedly mounted, at a second hinge location 58, to a rear portion of either a chair 60 (Fig . 5) or a bed 62 (Fig. 6), or onto a wall 70 via a suitable wall mounting 72 (Fig. 7). The air treatment unit 12 is also hingedly attached to a top end 64 of upper arm 52.

As seen in Figs. 5 and 6, system 10 may be used both during the day, when it may expected that a user would be seated in a chair 60, and at night, when it may be expected that the user would be lying down in bed 62. It is known that certain body conditions, including body temperature and respiratory rate, change during the nighttime, and so the treatment requirements of a user may also change.

Furthermore, changes in these body parameters are also experienced during different times of the day, and between one day and another in accordance with the season, thereby leading to different user requirements.

Referring now briefly to Fig. 10, there is seen an arrangement, referenced generally 100, which is generally similar to that of Fig. 6, and which is thus not described herein, in detail. Features in the drawing having counterpart features in Fig. 6, are indicated by similar reference numerals in Fig. 10, except with the addition of a prime (') suffix.

In the present embodiment, it is seen that adjustable flow guide 16' is extended such that free edges thereof, indicated 17, are seen to be touching, or nearly touching bedclothes 19. It has been found by the Inventors that, provision of extended flow guide 16' further isolates the space surrounding a user's respiratory passages, so as to achieve a respiratory comfort level suitable also for chronic nighttime conditions, such as nocturnal asthma. It will be appreciated, however, that not all nighttime conditions may require use of the extended flow guide 16'.

As indicated by double-headed arrow 21, flow guide 16' is preferably formed of a concertina type or other suitable type of extensible, such that a user may extend it as needed, between a retracted position, shown by dashed lines 23, and a fully extended position, shown in full lines.

The inventor has, therefore, found that an optimum use of the system of the present invention can be obtained by operating it in accordance with a preselected therapeutic comfort cycle, during which the temperature and relative humidity of the treated air is varied. A further advantage of such a cycle is the fact that by varying operating conditions, a user does not become dependent on the therapeutic effect of the apparatus. This will be understood with reference to Figs. 8A and 8B. By way of example, when a user is located in the same place for a long period, in a generally unchanging position relative to the apparatus of the invention, such as during the night, it may be sought to operate the apparatus in accordance with a predetermined thermo-regulation cycle, such as shown in Fig. 8B, as opposed to normal "thermo-constant" regime, in which the temperature is generally stable, varying only by about ±1.5°C, as seen in Fig. 8A. The need to provide a thermo-cycle such as shown in Fig. 8B, is that, if the user is exposed to a thermo-stabilized environment for a long period, and is subsequently is exposed to ambient air, when he leaves the thermo-stabilized environment, he is liable to experience discomfort.

In order to prevent this from happening, there may be provided a thermo-cycle, during which the temperature is varied gradually, over a predetermined time cycle having a predetermined temperature amplitude. As seen in Fig. 8B, the varying thermo-cycle has an amplitude greater than that of the regime of Fig. 8A, and a selected half-cycle time. Preferably, the amplitude of the varying thermo-cycle is about 4-5°C, the half-cycle time is in the range 5-25 minutes, and the temperature changes at a rate of 0.2-1°C per minute.

In general, however, the following have been found to be important parameters of the treated air envelope produced in accordance with the present invention, the provision of which has been found to be advantageous for various respiratory conditions:

1. degree of contamination permitted in treated air - "class 100-1000." This is the maximum allowable number of particles having a size of at least 0.5 microns, per cubic foot of air, as per US Federal Standard 209.
2. air temperature - 30-36°C
3. relative humidity of treated air - optimum is 40-60%
4. volumetric treated airflow - 20-40 m^3 per hour
5. rate of air change - 400-600 changes per hour
6. stability of temperature of ± 1.5°C (Fig. 8A). Alternatively (Fig. 8B), there may be provided a cycle having an amplitude of 4-5°C and a half cycle time of 5-25 minutes.
7. maximum noise level of 50 dBA or less

Various parameters of those listed above, particularly of air temperature and relative humidity, are integrated so as to obtain a respiratory comfort level. This integrated comfort level is preferably determined by a physician so as to have the most beneficial effect on the overall state of a user, and may be such as shown and described above in conjunction with Fig. 8B.

Referring now to Fig. 9, there is shown an air treatment unit 112, which is constructed and operative in accordance with an alternative embodiment of the invention. While the function of unit 112 is broadly similar to that of unit 12, (shown and described above in conjunction with Figs. 2A and 2B,) the present unit 112 has is characterized by having a simplified, compartmentalized construction. One advantage accruing from this simplified construction is the generally linear throughflow of air, resulting in a unit which is more efficient, and which requires less acoustic insulation.

It is thus seen that unit 112 includes a housing 122, in which are formed one or more untreated air inlets 124 and a treated air outlet 126. Housing 122 is divided into an air entry chamber 180, a blower chamber 182, and a heating and air exit chamber 184. Air entry chamber 180 and outlet chamber 184, and, optionally, blower chamber 182, have walls 183 formed of a suitable acoustic insulation material, for example, an open- or closed-cell polyethylene foam material such as ILSONIC®, manufactured by Illbruck GmBH, of Leverkusen, Germany.

A suitable blower 130, such as that having mixed axial and centrifugal flow characteristics, is located in blower chamber 182, and is operative to develop thereacross a negative pressure gradient, thereby to cause ambient air to be pumped or drawn into chamber 180 via ambient air inlets 124, and to force the air out through treated air outlet 126, via outlet chamber 184. Air is drawn into blower chamber 182 via a suitable prefilter 125 and a honeycomb like flow guide 127, which extend the full width of housing 122, and which further serve to separate entry chamber 180 from blower chamber 182. Flow guide 127 may be made from a suitable activated carbon, open pore filter medium, adapted for the removal of small airborne impurities. A an example of a suitable material for this purpose is the NANOSORB® filter medium, manufactured by Blucher GmbH, of Parkstrasse 10, D-40699, Erkrath, Germany.

A HEPA filter 188, typically of a pleated type, is located in treated air outlet 126. Filter 188 is hermetically sealed to edges 190 of the insulated side walls of chamber 184, thereby to ensure that only uncontaminated air, as defined above, exits the unit. A suitable heating unit 128, for example, the Zig-Zag™ heating element, as manufactured by Fritz Eichenauer GmBH & Co., D6729, Hazenbul, Industry Strasse 1, Germany, is located immediately downstream of the blower outlet 192, such that the air supplied thereto by blower 130, is heated to a preselected temperature. A humidifier (not shown), as described above in conjunction with Figs. 2A and 2B, may also optionally be provided.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been specifically shown and described hereinabove, merely by way of example. The scope of the invention is limited, rather, solely by the claims, which follow.

CLAIMS

1. A system for treating air which comprises:

air treatment means for treating ambient air so as to bring it to a preselected respiratory comfort level and for providing a treated air outflow;

guide means for guiding said treated air outflow so as to obtain a selected treated air outflow distribution; and

positioning means for selectably positioning said guide means relative to the head of a user thereby to form a treated air envelope surrounding his respiratory openings, and having said preselected respiratory comfort level, thus isolating the user from ambient comfort conditions.

2. A system according to claim 1, wherein said positioning means is operative to enable positioning of said guide means in non-touching association with and generally above the head of the user, thereby to direct said treated air in a generally downward direction, past the nasal openings of the user.

3. A system according to claim 1, wherein said air treatment means comprises:

an insulated housing, having formed therein ambient air inlet means and treated air outlet means;

pump means, for pumping ambient air into said housing through said inlet means and for pumping treated air out of said housing via said treated air outlet means, along a flow path;

heater means, located downstream of said inlet means, for heating air flowing along said flow path to a preselected temperature; and

filter means, located upstream of said outlet means, for removing contaminants from the air flowing along said flow path.

4. A system according to claim 3, and wherein said insulated housing is operative to reduce noise outside of said housing and in the vicinity thereof, to no more than 50 dBA.

5. A system according to claim 3, wherein said guide means is mounted onto said treated air outlet means for receiving therefrom said treated air, and has a selectable cross-sectional area.

6. A system according to claim 5, wherein said guide means has a generally elongate, extended shape, predetermined to generally isloate the respiratory passages of a user from ambient air.

7. A system according to claim 5, wherein said guide means is extensible between a relatively retracted position and a relatively extended position, whereat it is operative to generally isolate the respiratory passages of a user from ambient air.

8. A system according to claim 1, wherein said air treatment means comprises:

a housing having formed therein ambient air inlet means and treated air outlet means;

an air entry chamber, for receiving ambient air via said air inlet means;

a blower chamber, arranged contiguously with said air entry chamber;

a treated air outlet chamber arranged contiguously with said blower chamber, for providing treated air to said outlet means;

blower means, arranged in said blower chamber, for causing a negative pressure gradient across said blower chamber, thereby causing ambient air to be pumped into said into said air entry chamber through said inlet means and for forcing treated air out of said blower chamber and out of said housing through said air outlet means, via said outlet chamber, along a predetermined flow path; and

filter means, located downstream of said blower means, for removing contaminants from the air flowing along said flow path.

9. A system according to claim 8, wherein at least said air entry chamber and said air outlet chamber are acoustically insulated.

10. A system according to claim 8, and also comprising heater means, located downstream of said inlet, for heating air flowing along said flow path to a preselected temperature.

11. A system according to claim 8, wherein said inlet, said entry chamber, said blower chamber, said outlet chamber, and said outlet define a linear flow path for air passing through said air treatment means.

12. A method of providing treated air to a person, comprising the steps of:

treating ambient air so as to bring it to a preselected respiratory comfort level;

providing a treated air outflow; and

guiding the treated air outflow so as to obtain a flow distribution in close proximity to the head of a user, thereby to form a treated air envelope surrounding his respiratory openings, and having said preselected respiratory comfort level, thus isolating the user from ambient comfort conditions.

13. A method according to claim 12, wherein said step of guiding comprises guiding the airflow in a generally downward direction, past his nasal openings.

14. A method according to claim 13, wherein said step of treating comprises:

pumping ambient air along an insulated flow path;

heating air flowing along the flow path to a preselected temperature; and

filtering the air flowing along the flow path, thereby to remove contaminants therefrom.

15. A method according to claim 14, and wherein said step of guiding the treated airflow comprises the sub-step of adjusting the cross-sectional area thereof.

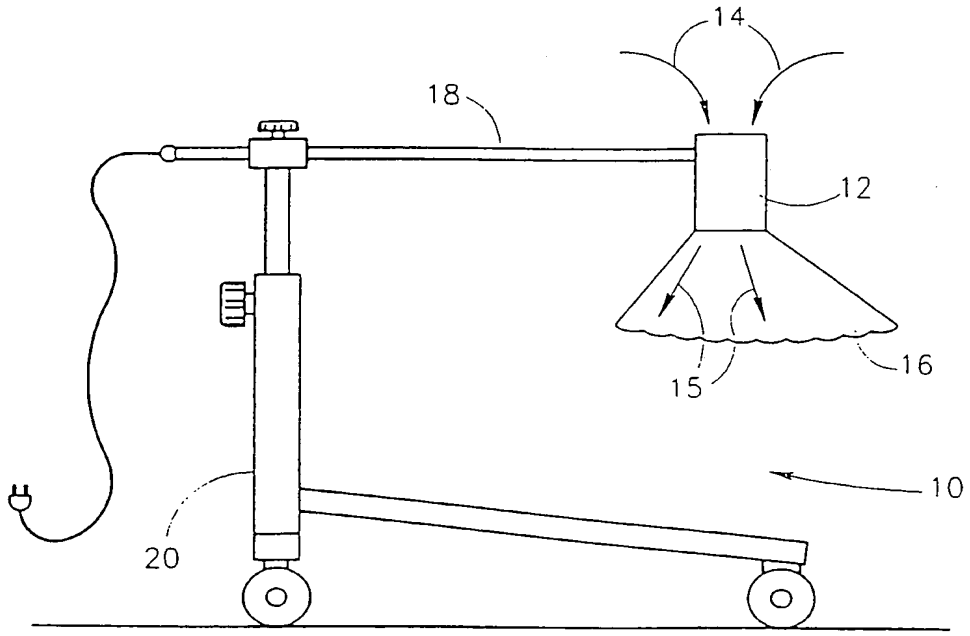

FIG. 1

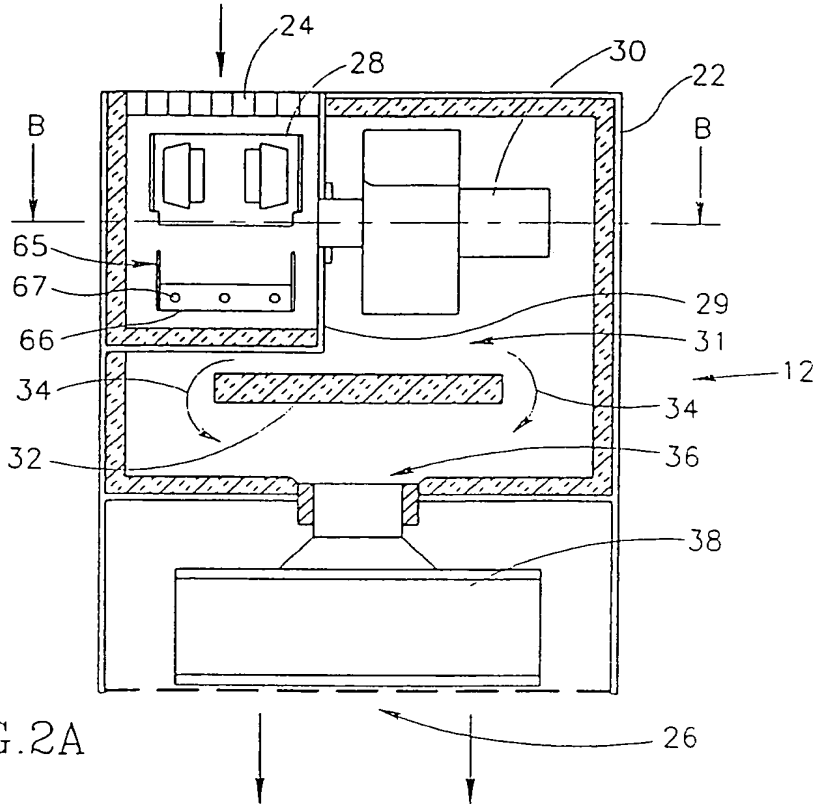

FIG.2A

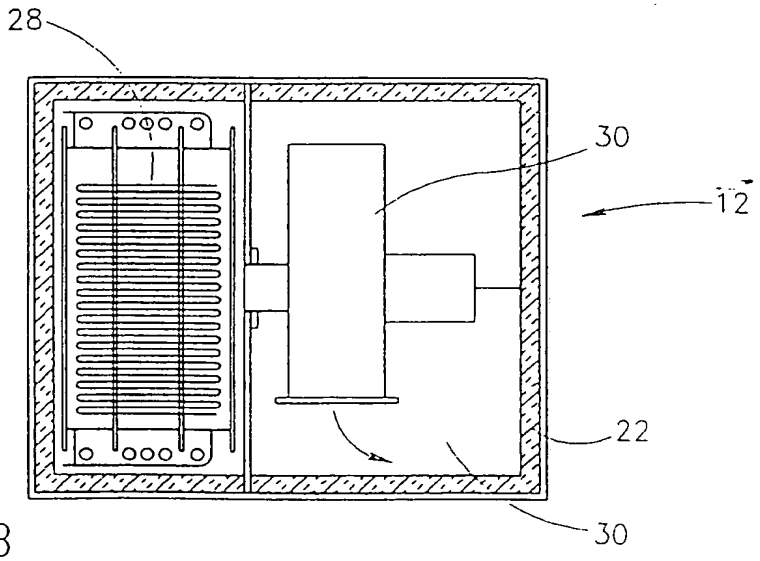

FIG.2B

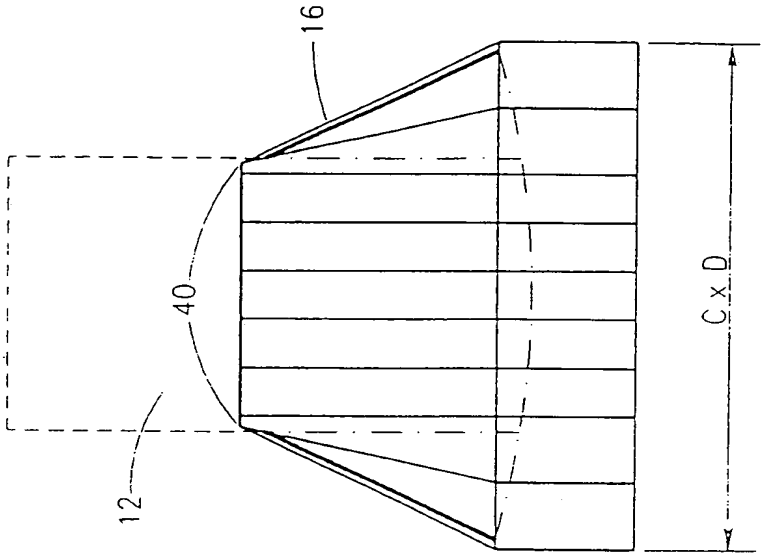

FIG.3B

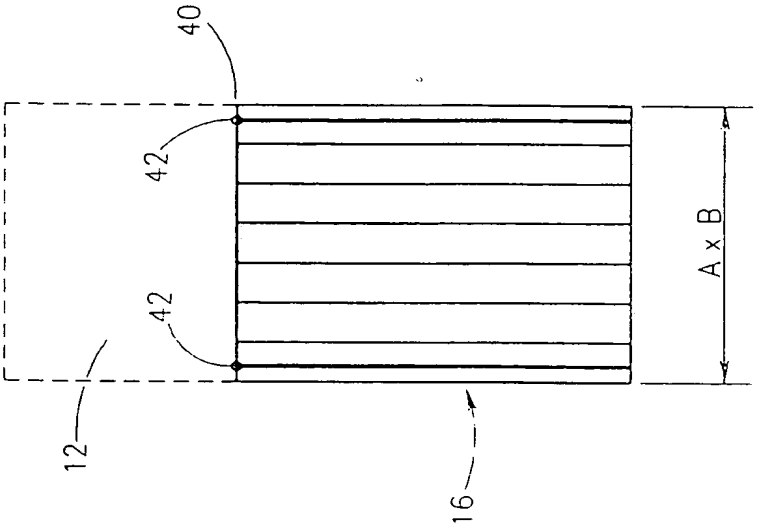

FIG.3A

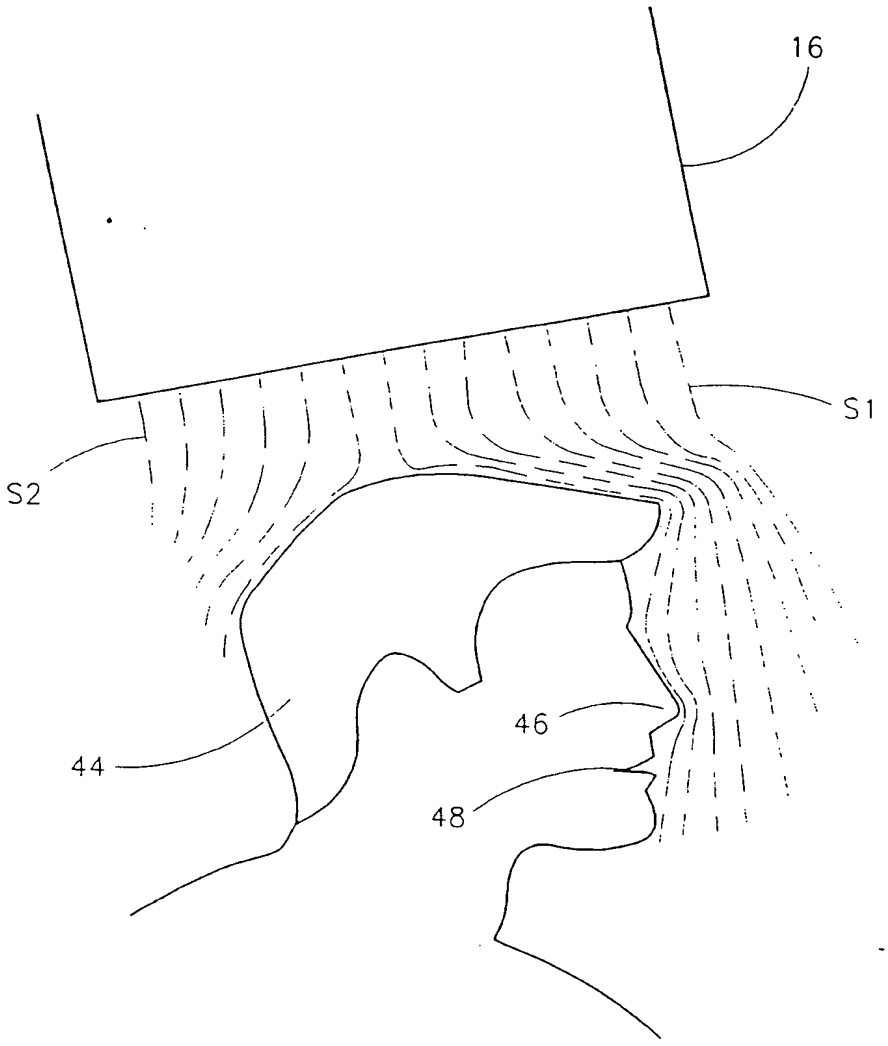

FIG.4

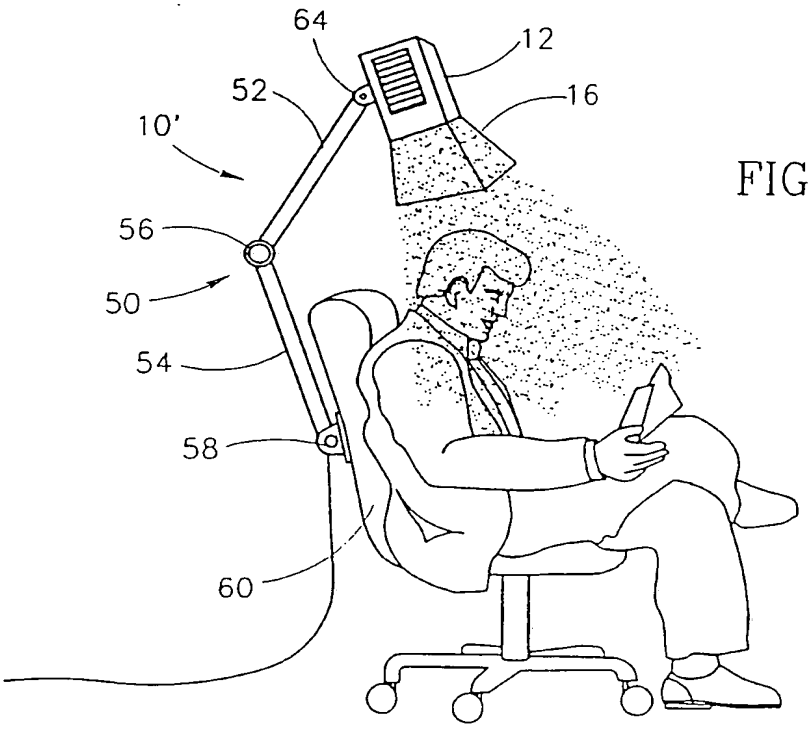

FIG.5

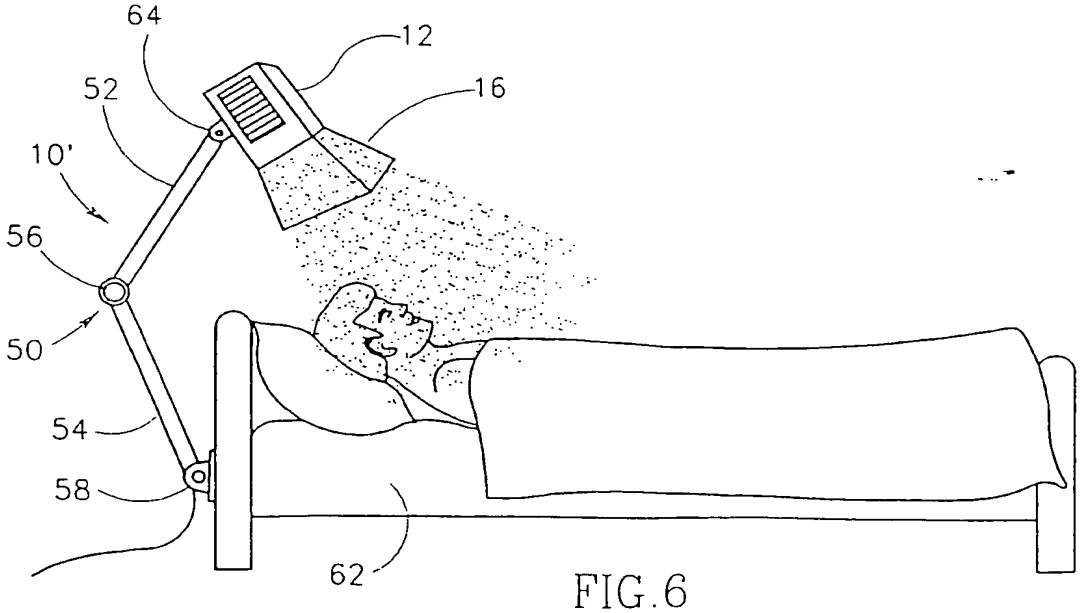

FIG.6

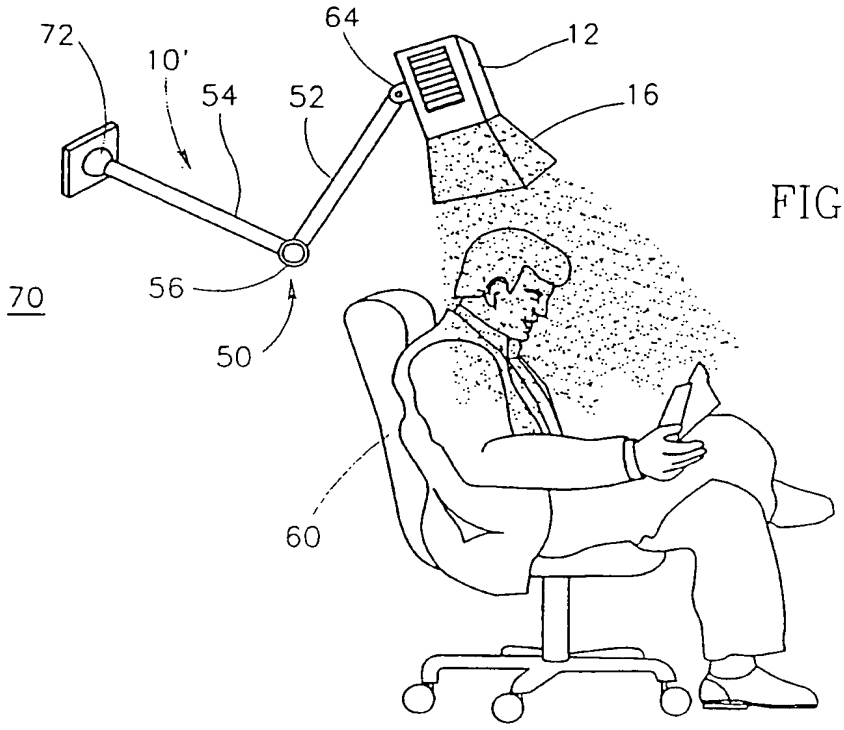

FIG.7

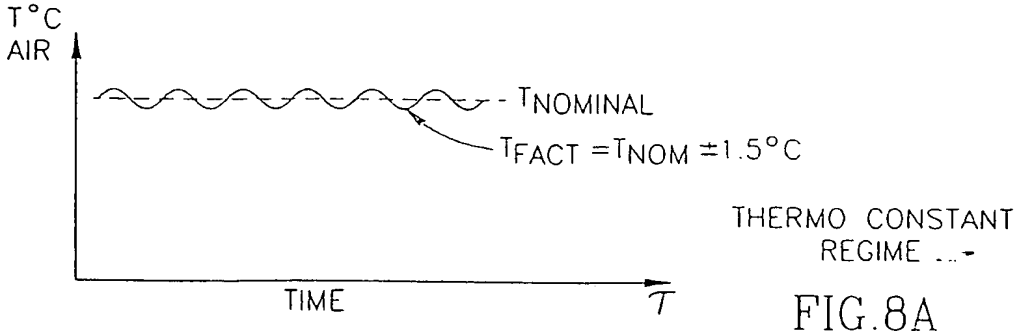

FIG.8A

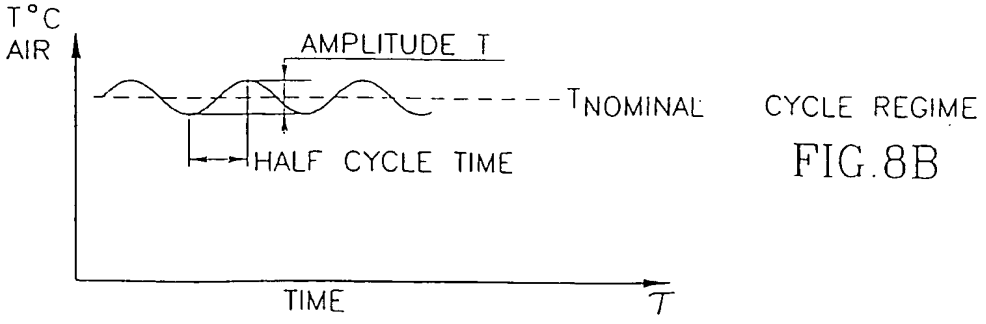

FIG.8B

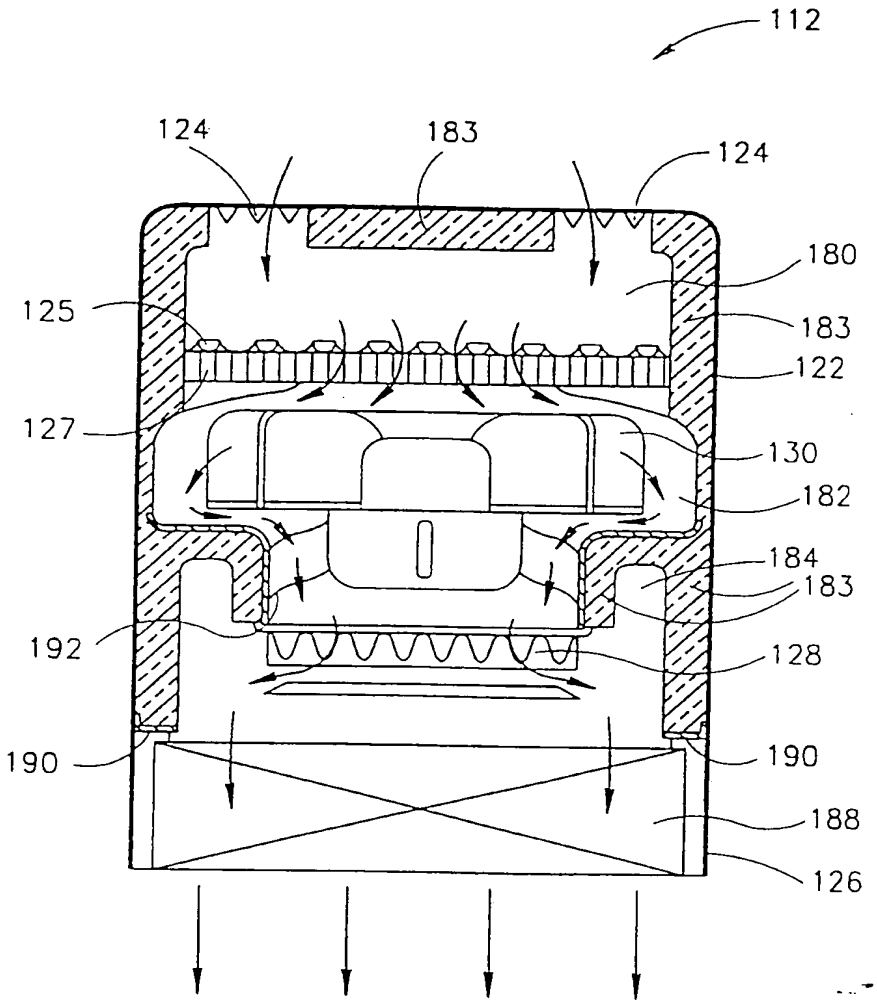
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FIG.9

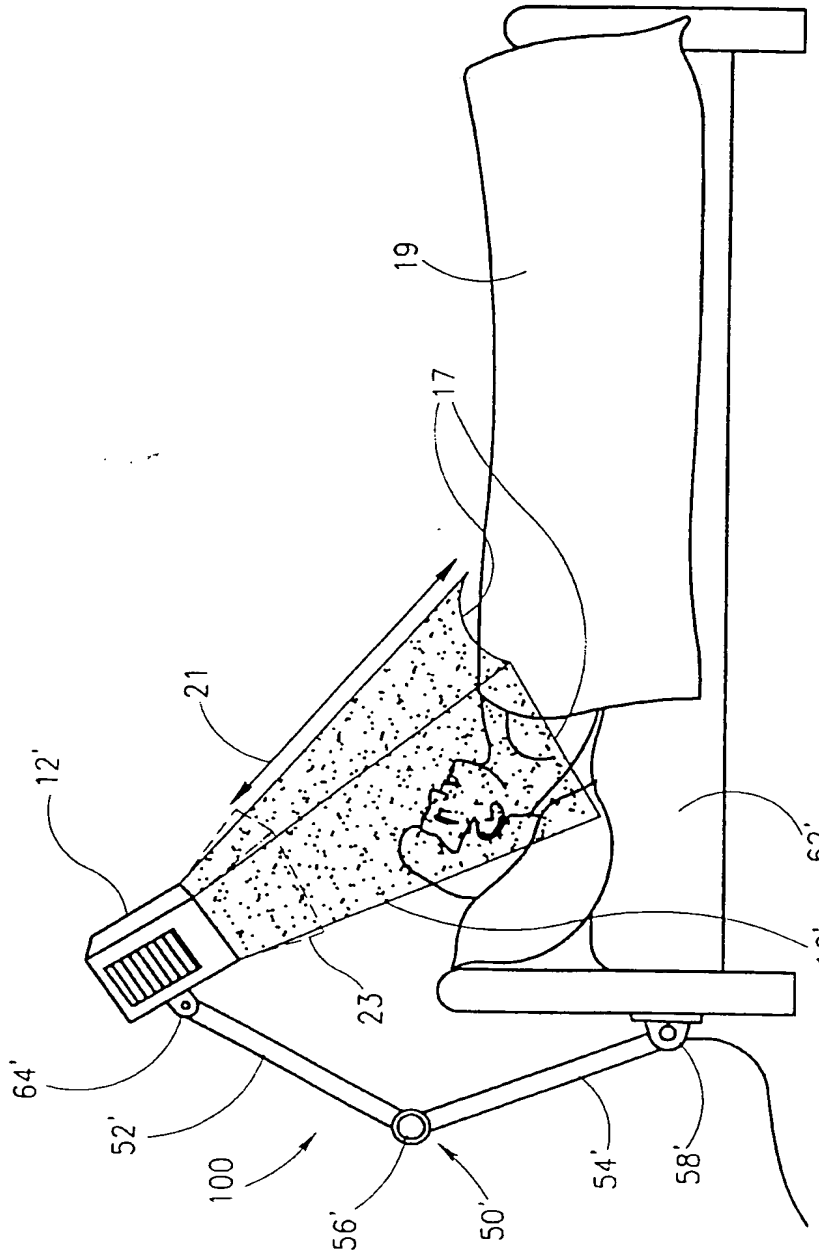

FIG.10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL97/00345

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) :A61G 10/00; A61M 15/00; A62B 29/00, 31/00, 37/00
US CL :128/200.24, 200.28, 205.26
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 128/200.24, 200.28, 205.26

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3,385,036 A (WEBB) 28 May 1968, Figs..1, 2, 6, and col. 4 lines 52-61.	1-15
Y	US 4,407,280 A (TRAMMELL et al) 04 October 1983, Fig. 4, and col. 5 lines 52-55.	4
Y	US 5,188,099 A (TODESCHINI et al) 23 February 1993, col. 2 lines 50-59.	3, 10, 14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
08 FEBRUARY 1998

Date of mailing of the international search report
24 FEB 1998

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